

A Taxonomic Study on the Leafhopper Genus *Scaphoidella* Vilbaste (Hemiptera: Cicadellidae: Deltocephalinae) from China

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All six species of the leafhopper genus *Scaphoidella* Vilbaste from China are reviewed. Among them, two new species, *S. undosa* sp. nov. and *S. acaudata* sp. nov., are described; two new combinations, *Scaphoide. unihamata* (Li et Kuoh) comb. nov. and *Scaphoidella wideadeaga* (Wang et Li) comb. nov. are proposed; and two new synonyms are revealed, *Scaphoideus inermis* Cai et He (2001) syn. nov. as a junior synonym of *Scaphoidella unihamata* (Li et Kuoh 1993) and *Scaphoideus multipunctus* Li et Dai (2004) syn. nov. as a junior synonym of *Scaphoidella stenopaea* Anufriev (1977). A key is given to separate all six Chinese species, and illustrations of genitalia are provided.

Key words: Hemiptera, Auchenorrhyncha, Cicadina, leafhoppers, *Scaphoidella*, China, key, identification

INTRODUCTION

Leafhoppers (Insecta: Hemiptera: Auchenorrhyncha) are some of the commonest insects in temperate and tropical ecosystems and by their feeding habits (plant sap feeders) are an influential component in forests and agricultural areas. Unlike their close relatives, the cicadas, whose songs are commonly heard in these areas, the calls of leafhoppers are inaudible to the human ear but are heard and responded to only by individuals of the same species as vibrations through the plant on which they are sitting. In addition, leafhoppers are much smaller insects than cicadas, ranging from 3–20 mm. As their name suggests, they are adept at jumping, but unlike other 'hopping' bugs, their long hind tibiae have four rows of setae.

The largest and most economically important leafhopper subfamily is the Deltocephalinae. This group, which is universally distributed with over 3,000 species, is well represented in Southeast Asia and adjacent areas, particularly on grasses. One genus of this subfamily, *Scaphoidella* Vilbaste (Athysanini), forms the subject of the present work. This genus was established for its type species *Scaphoidella arboricola* Vilbaste from the former Soviet Maritime Territory. Anufriev (1977) later described a second species (*Scaphoidella stenopaea*), and recently, Cai *et al.* (2001) described a third species (*Scaphoidella inermis*) from Zhejiang, China. In the present paper, six species of the genus are recognised and illustrated (including two new species from China) and a key is given for their identification. In addition, two new combinations are made and two new spe-

cies synonyms proposed.

MATERIALS AND METHODS

Specimens for this study are deposited in the institutions abbreviated in the text as follows: BMNH, The Natural History Museum, London, UK; NWAUFU, Entomological Museum, Northwest A&F University, Yangling, Shaanxi, China; SEM, Shanghai Entomological Museum, Chinese Academy of Sciences, Shanghai, China. All specimens were examined with a Leica ZOOM2000 stereomicroscope, hand-drawings of the male genitalia were made with an OLYMPUS PM-10AD microscope, and external figures were made with a Nikon AFX stereomicroscope, both a with drawing tube attachment. The morphological terminology used in the descriptions mainly follows Zhang (1990). Absolute measurements, in millimeters (mm), are used for the body length taken from the apex of the head to the apex of the forewings.

TAXONOMIC ACCOUNTS

Scaphoidella Vilbaste, 1968

Scaphoidella Vilbaste 1968, 133.

Type species: *Scaphoidella arboricola* Vilbaste, 1968.

Diagnosis. This genus is superficially similar to *Scaphoideus* Uhler but can be distinguished from the latter by: transverse veins in costal field of forewing forming a right angle with costal margin, subgenital plate with numerous macrosetae arranged irregularly or in a single row along outer margin, aedeagus articulated with connective and with its paraphyses fused with shaft. For the latter genus: transverse veins in costal field of forewing inclined to the costal margin, subgenital plate with only several macrosetae at margin, aedeagus separated from connective and its paraphyses. We follow Oman *et al.* (1990) in placing *Scaphoidella* in Athysanini.

Description. Small, elongate leafhoppers. Head and thorax yellow to pale brown with dark-brown markings; forewings hyaline with black or dark-brown veins and dark-

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ening in most cells; two spots on inner claval margin at confluences of anal veins as well as two spots on transverse veins in costal field, black. Head including eyes narrower than pronotum. Crown longer medially than next to eyes but shorter than width between eyes; anterior margin in dorsal view produced anteriorly and rounded; disc somewhat flat. Transition of vertex and frontoclypeus rounded. Eyes fairly large. Ocellus situated on frontal margin of crown, separated from eye by distance equal to or less than ocellus diameter. Frontoclypeus narrow, longer than width between eyes. Clypellus slightly expanded apically. Pronotum with anterior margin produced and rounded, posterior margin slightly concave. Scutellum almost as long as 1.5 times length of head, with curved transverse depression. Forewing appendix wide; inner subapical cell open; four apical cells. Female with abdominal sternum VII 3–5 times length of abdominal sternum VI, its caudal margin produced posteriorly. Male pygofer longer than broad in lateral view, often with a caudal prolongation (except for *S. acaudata* and *S. wideaedeaga*), posterior margin with several macrosetae. Subgenital plate long, triangular, distal half with several macrosetae laterally arranged irregularly or in a single row. Style with apical process moderate to long with a slight projection near middle of inner side; preapical lobe prominent. Connective Y-shaped, shaft short. Aedeagus with a pair of well-developed basal paraphyses; shaft long, with or without apical processes, gonopore apical on ventral surface.

Distribution. China, Russia.

Checklist of species of the genus *Scaphoidella* Vilbaste

S. arboricola Vilbaste, 1968. Russia (Maritime Territory), China (Zhejiang, Henan).

S. stenopaea Anufriev, 1977. Russia (Amur Province, Maritime Territory), China (Shaanxi, Shandong, Heilongjiang, Liaoning).

S. unihamata (Li and Kuoh, 1993), new comb. China (Zhejiang, Hunan, Fujian).

S. wideaedeaga (Wang and Li, 2004), new comb. China (Yunnan, Xizang).

S. undosa n. sp. China (Henan, Hunan, Jiangxi, Hubei, Guizhou, Zhejiang).

S. acaudata n. sp. China (Yunnan).

Key to species of the genus *Scaphoidella* Vilbaste

1. Subgenital plate with irregularly arranged macrosetae laterally (Figs. 4, 5, 14, 15)..... 2
Subgenital plate with a row of macrosetae laterally (Figs. 26, 27, 33, 35, 44, 45, 55)..... 3
2. Pygofer process long; subgenital plate tapering apically; basal paraphyses of aedeagus extending to near apex of shaft (Figs. 14–19, 21)..... *S. undosa* sp. nov.
Pygofer process short; subgenital plate rounded apically; basal paraphyses of aedeagus extending beyond shaft (Figs. 4–7, 9)..... *S. arboricola*
3. Pygofer side with caudal process (Figs. 26, 33, 34)..... 4
Pygofer side without caudal process (Figs. 44, 54)..... 5
4. Aedeagal shaft straight, with a pair of lateral processes at apex; preatrium short. Style apical process moderately long (Figs. 27–29)..... *S. stenopaea*
Aedeagal shaft curved dorsally, without processes at apex; preatrium very long. Style apical process very long

- (Figs. 35–37, 39)..... *S. unihamata*
5. Pygofer with side tapering to narrowly rounded apex; aedeagal shaft in lateral view slender, gradually tapering toward apex (Figs. 54, 57)..... *S. acaudata* sp. nov.
Pygofer side broadly rounded apically; aedeagal shaft in lateral view distinctly broadened preapically (Figs. 44, 47)..... *S. wideaedeaga*

Scaphoidella arboricola Vilbaste

Figs. 1–10

Scaphoidella arboricola Vilbaste, 1968, 133, plate 110, Figs. 1–8; Nast, 1972, 357; Anufriev and Emeljanov, 1988, 191, Plate 129, Figs. 14–18; Cai and Shen, 1999, 244; Cai, He, and Gu 2001, 205.

Material examined. 3 ♂, 2 ♀, China: Zhejiang Prov., Hangzhou, Zhiwuyuan, 4–14 June 1982, Coll. Yan Hengyuan, Nos. 18020093, 18020128, 18020142, 18020147, 18020148 (all deposited in SEM).

Distribution: Russia (Maritime Territory), China (Zhejiang, Henan).

Scaphoidella undosa Zhang and Dai sp. nov.

Figs. 11–22

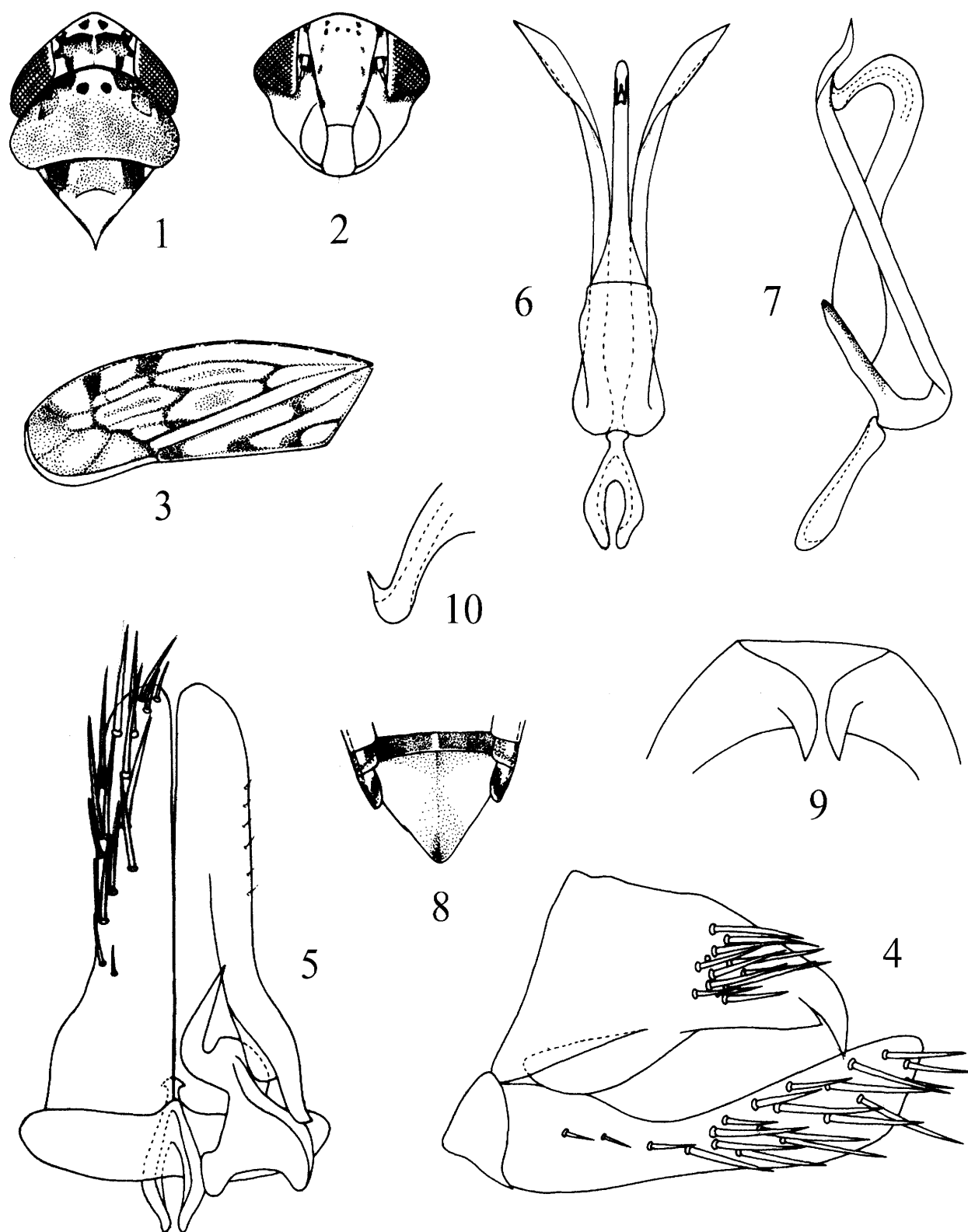
Diagnosis. This species is superficially similar to *Scaphoidella arboricola* Vilbaste but can be distinguished from the latter by: 1) pygofer processes long; 2) subgenital plate tapering more apically; 3) basal paraphyses of aedeagus not extending beyond apex of shaft.

Etymology. Named for its undose (sinuate) aedeagal shaft in lateral view.

Type material. Holotype: ♂, China: Hunan Prov., Chenzhou, Suxianling, 18 Aug. 1985, Zhang Yalin and Chai Yonghui, No. HO051751. Paratypes: China, 2 ♂, 1 ♀, Hunan Prov., Changde, Huananchang, 22–23 July 2002, Sun Qinxia, Nos. HO051754, HO051746, HO051750; 2 ♂, 1 ♀, Hunan Prov., Changde, Huananchang, 20–25 July 2002, Yuan Zhonglin, Nos. HO051752, HO051749, HO051745; 2 ♂, 1 ♀, Guizhou Prov., Fanjingshan, Huguoshi, 1,300 m, 1–2 August 2001, Sun Qiang, Nos. HO051741, HO051742, HO051743; 1 ♂, Hubei Prov., Wudangshan, 20 July 2001, Huang Min, No. HO051744; 1 ♀, Henan Prov., Xixia, Huangshian forest, 17 July 1998 at night, 800–1,300 m, Hu Jian, No. HO051747; 1 ♂, 1 ♀, Zhejiang Prov., Gutian Mountain, 17–19 August 2003, 333 m, Dai Wu, Nos. HO051753, HO051756; 1 ♀, Zhejiang Prov., Gutian Mountain, Caodian, 18 August 2003, 845 m, Dai Wu, No. HO051755; 1 ♂, Jiangxi Prov., Ruijin, Boyingxiang, 15 August 2003, 280 m, Wei Cong and Yang Meixia, No. HO051748; 1 ♀, Jiangxi Prov., Suichuan, Wuzhifeng, 13 August 2003, 760 m, Wei Cong and Yang Meixia, No. HO051759 (all of the above in NWAUFU); 1 ♀, Hunan Prov., Changde, Huananchang, 22 July 2002, Sun Qinxia (BMNH); 1 ♂, Hunan, Zhangjiajie, 25 July 2002, Sun Qinxia (BMNH).

Size. Length: ♂ 5.9–6.0 mm, ♀ 6.0–6.2 mm.

Description. Yellow to fuscous with well-expressed brown or black pattern. Vertex with a black spot each side of midline on fore margin and a broad, black transverse band between ocelli interrupted medially or paler posteriorly and to sides (Fig. 11). Face with frontoclypeus yellow, with well developed and often partly merged dark-brown arched lines; anteclypeus, genae, and lorae mostly brown (Fig. 12).



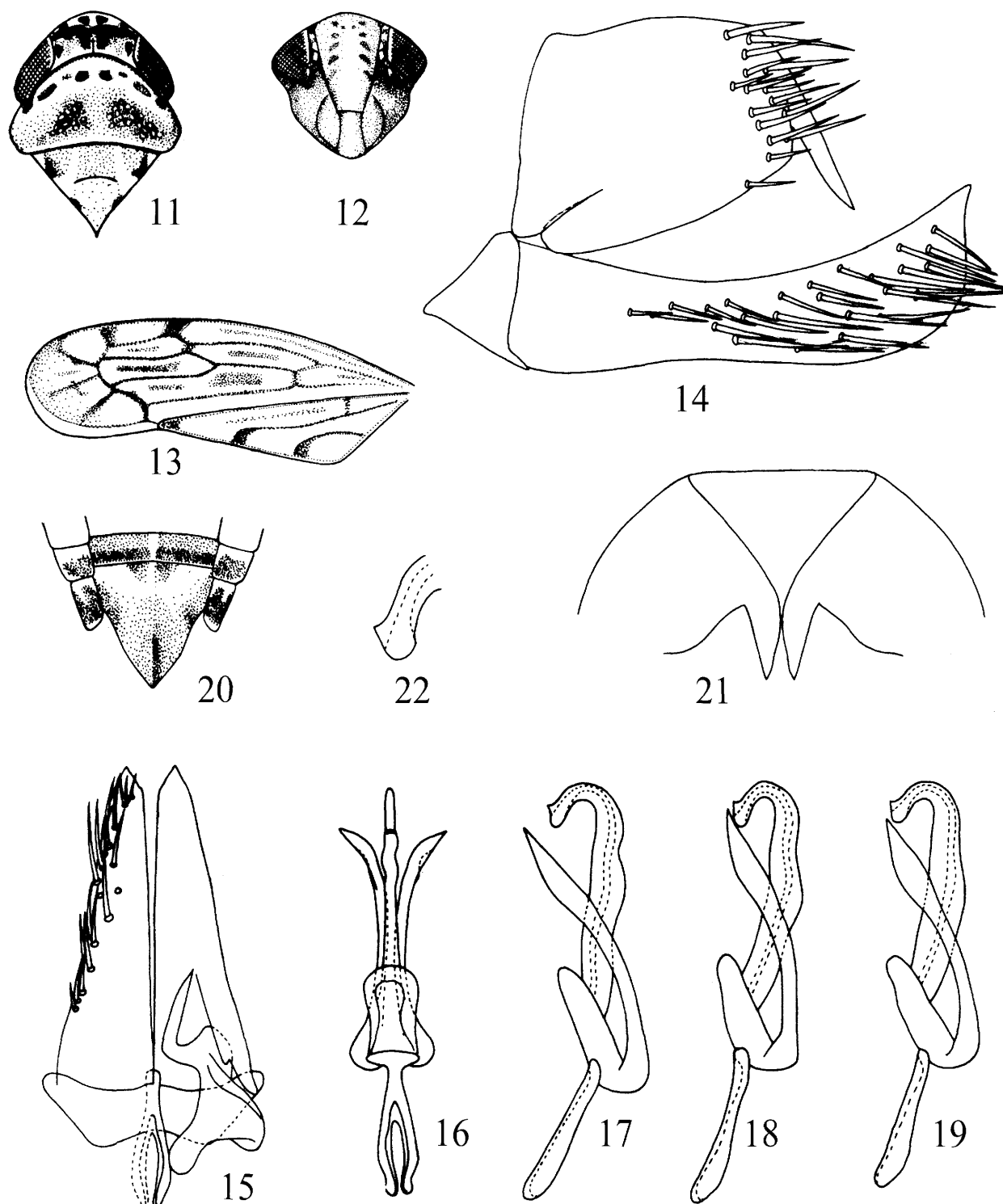
Figs. 1–10. *Scaphoidella arboricola* Vilbaste. 1) Head and thorax, dorsal view; 2) face; 3) forewing; 4) ♂ pygofer, left lateral view; 5) genital valve, subgenital plate, style, and connective, ventral (left) and dorsal (right) views; 6) aedeagus and connective, dorsal view; 7) aedeagus and connective, left lateral view; 8) ♀ abdominal sternum VII, ventral view; 9) Apex of pygofer side, caudal view; 10) apex of aedeagal shaft, left lateral view.

Pronotum brown-yellowish with four more-or-less blackish-brown merged spots on each side along anterior margin (Fig. 11). Scutellum pale yellow, with a triangular marginal spot anterior and posterior to scutellar suture, light brown (Fig. 11). Forewing hyaline; pale brown with black or dark-

brown veins and darkening in most cells; spot on apex of claval veins and on transverse costal veins, dark brown (Fig. 13).

External features as in generic description.

Pygofer side with long caudal process directed ventrally,



Figs. 11–22. *Scaphoidella undosa* sp. nov. **11)** Head and thorax, dorsal view; **12)** face; **13)** forewing; **14)** ♂ pygofer, left lateral view; **15)** genital valve, subgenital plate, style, and connective, ventral (left) and dorsal (right) views; **16)** aedeagus and connective, dorsal view; **17–19)** aedeagus and connective, left lateral view (17 from Hubei, 18 from Guizhou, 19 from Hunan); **20)** ♀ abdominal sternum VII, ventral view; **21)** apex of pygofer side, caudal view; **22)** apex of aedeagal shaft, left lateral view.

posterior margin with many macrosetae (Figs. 14, 21). Subgenital plate long, cuspidate at apex, covered with several lateral macrosetae (Figs. 14, 15). Styles with region basad of lateral lobe moderately long basally, inner apophyses moderately long and robust, outer apophysis short and robust; lateral lobe well-developed; apical processes moderately long and straight (Fig. 14). Connective Y-shaped with

shaft short and arms well developed (Figs. 15, 16). Aedeagus with shaft elongate, laterally compressed, relatively straight in lateral view with ventral margin sinuate, apex strongly curved dorsally, dentate subapically on ventral surface; gonopore apical; preatrium short with pair of elongate paraphyses, slightly curved dorsally, apices expanded and reaching near apex of shaft in lateral view, curved laterally

in ventral view (Figs. 16–19).

Distribution. China (Henan, Hunan, Jiangxi, Hubei, Guizhou, Zhejiang).

***Scaphoidella stenopaea* Anufriev**

Figs. 23–29

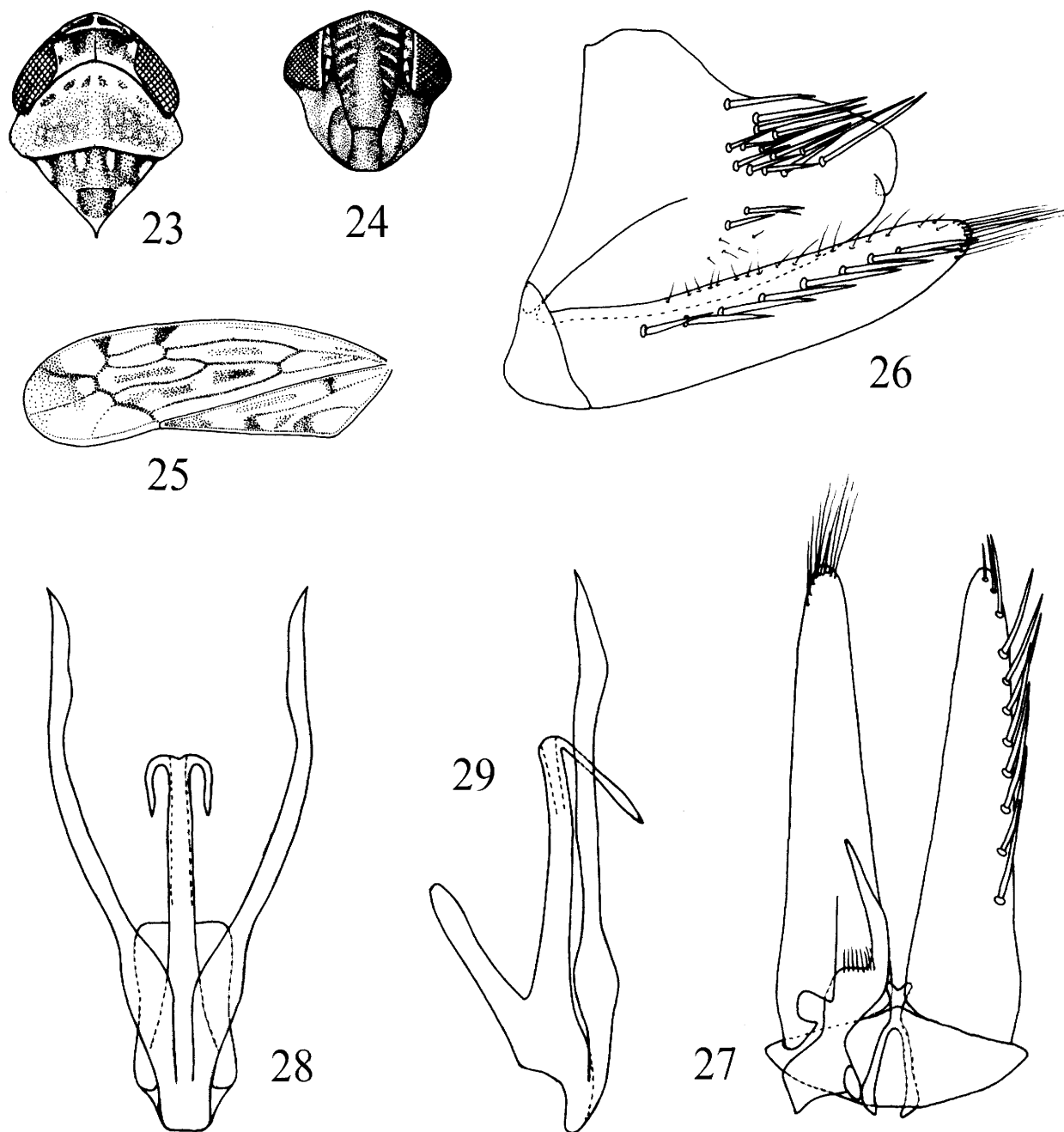
Scaphoidella stenopaea Anufriev, 1977, 213, Figs. 13–19; Anufriev and Emeljanov, 1988, 191, Plate 130, Figs. 1–7.

Scaphoideus multipunctus Li and Dai, 2004, 282, Figs. 7–12 (syn. nov.).

Material examined. China: 1 ♂, Shaanxi Prov., Wugong, 31 June 1982, at light, No. HO051757; 1 ♂, Shandong Prov., Yantai, Kunyu Mountain, 10 July 2001, Qin Daozheng

and Liu Zhenjiang, No. HO051758 (both of the preceding in NWAUFU); 1 ♂, Heilongjiang Prov., Yichun, Wuying, 13 August 1964, Chen Zhizi, No. 18025549 (deposited in SEM).

Remarks. This species was described from the Far East of Russia and northern China, based on seven specimens of both sexes that are deposited in the collection of the Zoological Institute of the Russian Academy of Sciences. Recently, Li and Dai (2004) described a new species from China, *Scaphoideus multipunctus*, but from a comparison of the original descriptions of both species and examining further material, it became clear that *S. multipunctus* is a junior synonym of *S. stenopaea* Anufriev.



Figs. 23–29. *Scaphoidella stenopaea* Anufriev. **23)** Head and thorax, dorsal view; **24)** face; **25)** forewing; **26)** ♂ pygofer, lateral view; **27)** genital valve, subgenital plate, style, and connective, dorsal (left) and ventral (right) views; **28)** aedeagus, ventral view; **29)** aedeagus, left lateral view.

Distribution. Russia (Amur Province, Maritime Territory), China (Shaanxi, Shandong, Heilongjiang, Liaoning).

***Scaphoidella unihamata* (Li and Kuoh) comb. nov.**

Figs. 30–40

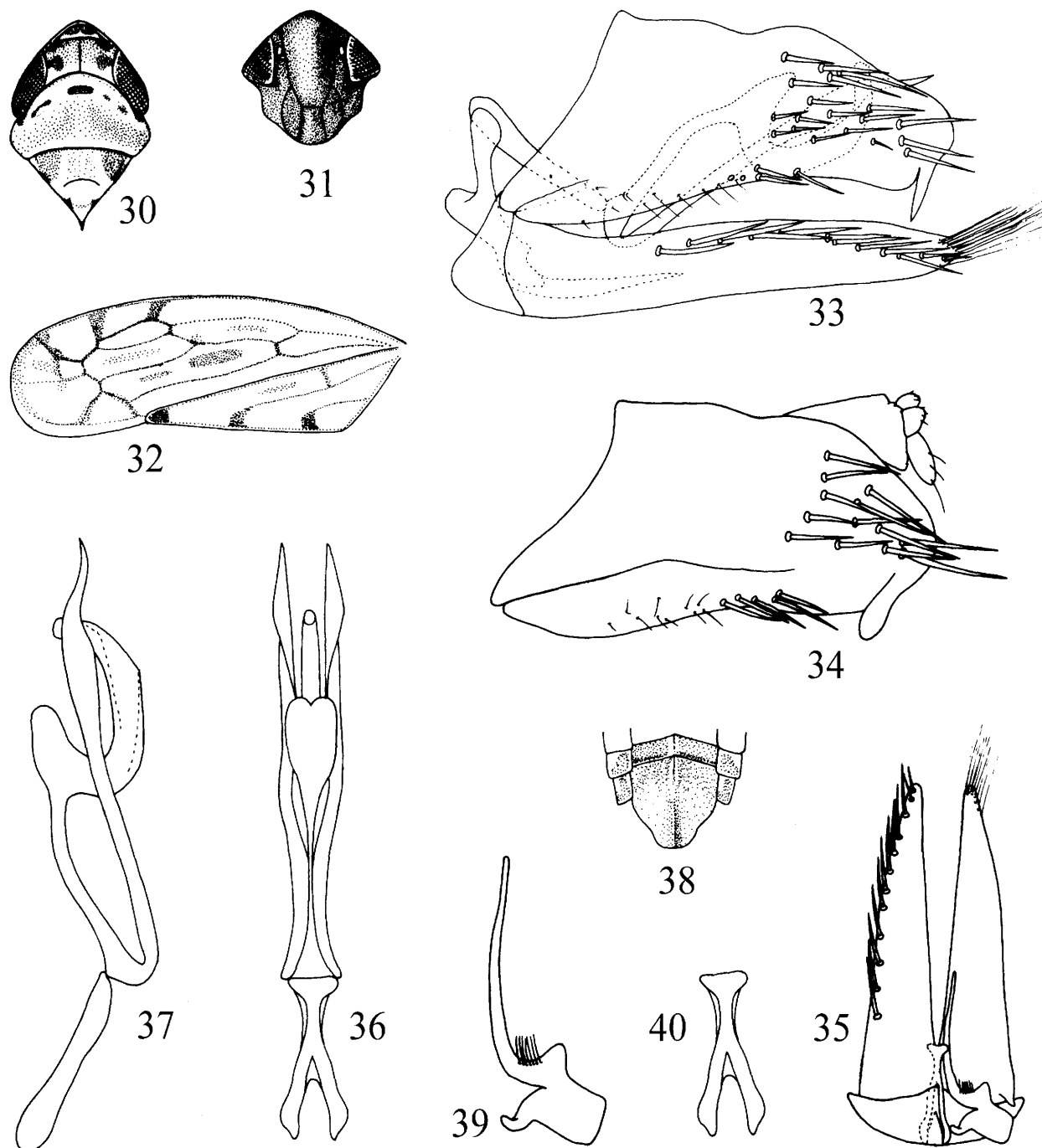
Scaphoideus unihamatus Li and Kuoh, 1993, 39, Figs. 7–12.

Scaphoidella inermis Cai and He, 2001, 205, Figs. 89–96 (syn. nov.).

Material examined. China: 22 ♂2 ♀, Hunan Prov., Chenzhou, 18–27 August 1985, Zhang Yalin and Chai Yonghui; 2 ♂2 ♀, Hunan Prov., Chenzhou, Suxianling, 18 August 1985,

Zhang Yalin and Chai Yonghui; 2 ♂1 ♀, Zhejiang Prov., Tianmu Mountain, 350 m, 24 August 2000, Dai Wu and Wei Cong; 1 ♂, Hunan Prov., forestry park, Zhangjiajie, 650 m, 7 August 2001, Sun Qiang (all the preceding in NWAUFU, Nos. HO051799 HO051832); 1 ♂1 ♀, Hunan Prov., Chenzhou, 18 August 1985, Zhang Yalin and Chai Yonghui (BMNH).

Remarks. This species, originally placed in *Scaphoideus*, was described from Fujian, China, based on three male specimens that are deposited in the Fujian Agricultural College collection. Later, Cai *et al.* (2001) described a new species, *Scaphoidella inermis*, from Zhejiang, but by comparing



Figs. 30–40. *Scaphoidella unihamata* (Li and Kuoh). **30)** Head and thorax, dorsal view; **31)** face; **32)** forewing; **33)** ♂ pygofer, lateral view; **34)** ♂ pygofer side from Hunan, lateral view; **35)** genital valve, subgenital plate, style, and connective, ventral (left) and dorsal (right) views; **36)** aedeagus and connective, dorsal view; **37)** aedeagus and connective, left lateral view; **38)** ♀ abdominal sternum VII, ventral view; **39)** right style, dorsal view; **40)** connective.

the original descriptions of both species and examining further material it is clear that *S. inermis* is a junior synonym of *S. unihamata* (Li and Kuoh).

Distribution. China (Zhejiang, Hunan, Fujian).

***Scaphoidella wideaedeaga* (Wang and Li) comb. nov.**

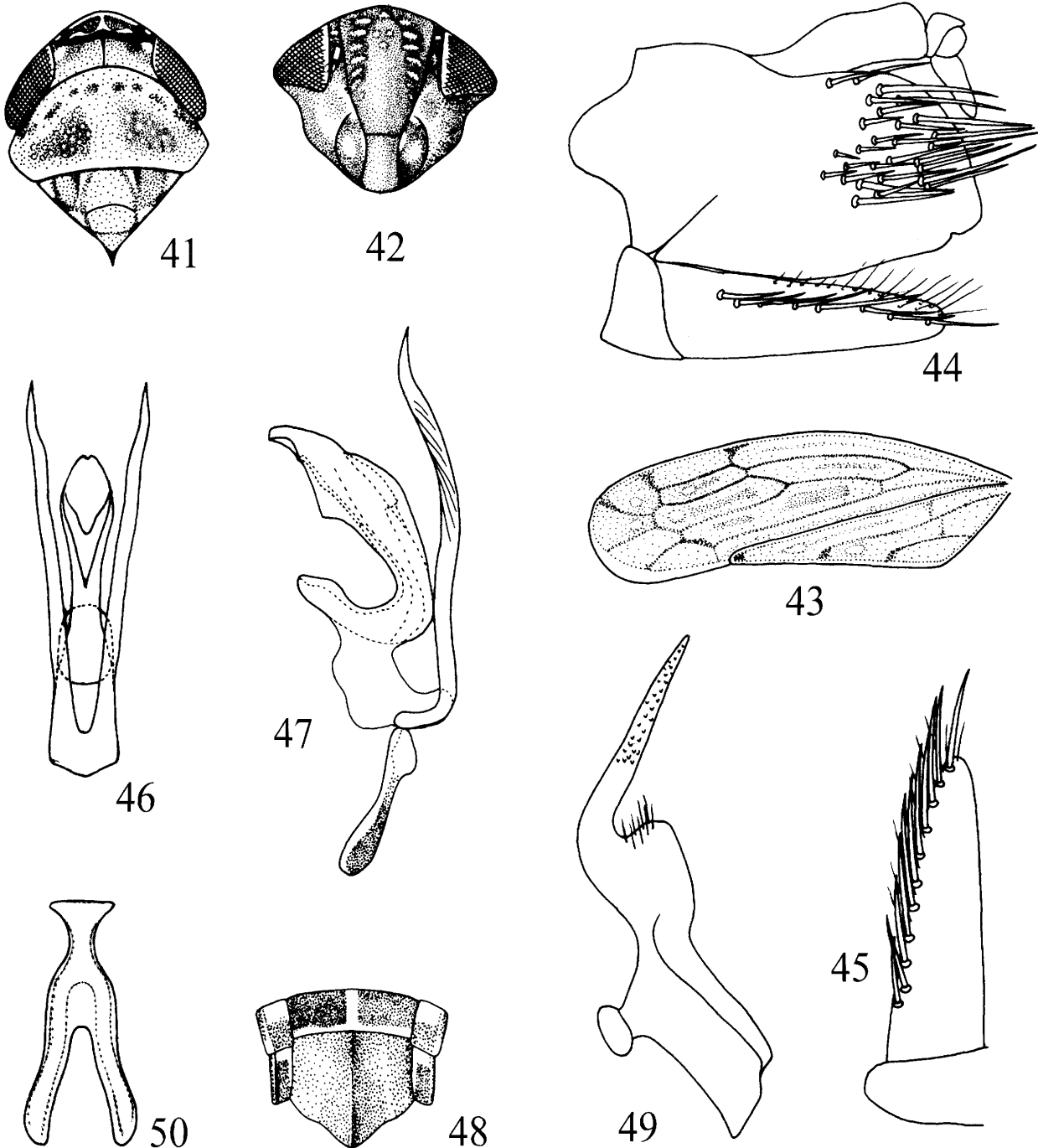
Figs. 41–50

Scaphoideus wideaedeagus Wang and Li, 2004, 17, Figs. 14–19.

Material examined. China: 1 ♀, Xizang Prov., Motuo, Maniwong, 1,050 m, 3 August 1979 at night, Jin Gentao and

Wu Jianyi, No. 18200398; 1 ♂, Xizang Prov., Motuo, 11 July 1980, 970 m, Jin Gentao and Wu Jianyi, No. 18203029; 1 ♂, Xizang Prov., Motuo, 1,310 m, 28 Sept. 1979, Jin Gentao and Wu Jianyi, No. 18202887 (all deposited in SEM).

Remarks. This species was described from Yunnan, China, based on one male specimen that is deposited in the Institute of Entomology, Guizhou University. From the original description and figures of Wang and Li (2004) and examination of specimens from Xizang (including their genitalia), it is clear that this species belongs to *Scaphoidella*.



Figs. 41–50. *Scaphoidella wideaedeaga* (Wang and Li). **41)** Head and thorax, dorsal view; **42)** face; **43)** forewing; **44)** ♂ pygofer, lateral view; **45)** genital valve and subgenital plate, ventral view; **46)** aedeagus, ventral view; **47)** aedeagus and connective, left lateral view; **48)** ♀ abdominal sternum VII, ventral view; **49)** right style, dorsal view; **50)** connective.

Distribution. China (Yunnan, Xizang).

***Scaphoidella acaudata* Zhang and Dai sp. nov.**

Figs. 51–58

Diagnosis. This species is superficially similar to *Scaphoidella unihamata* (Li and Kuoh), but can be distinguished from the latter by: 1) pygofer without process; 2) style with shorter apical process; 3) aedeagal shaft more elongate with two short latero-dorsal appendages near apex and preatrium short.

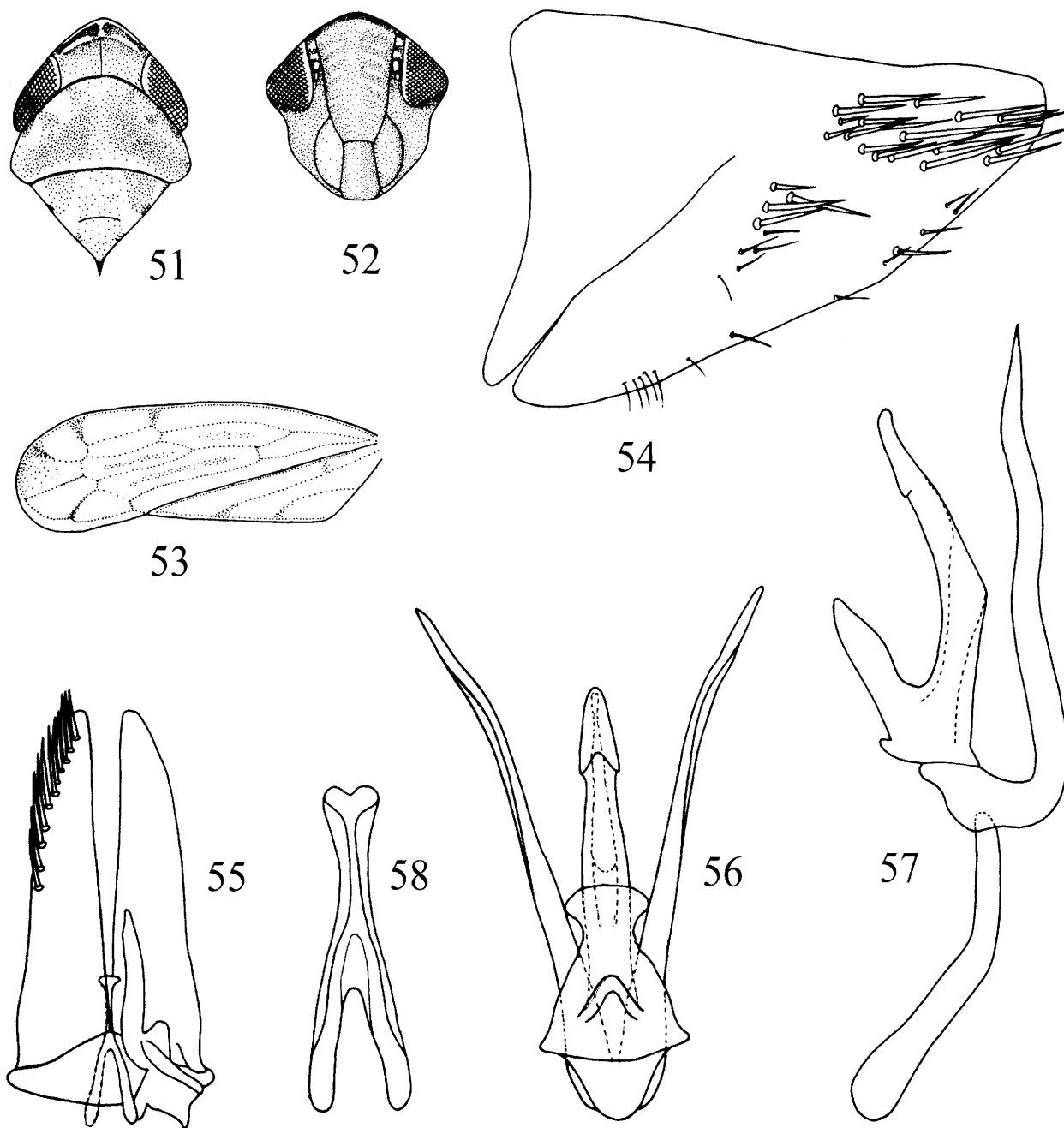
Etymology. This new species is named with *a-* and *caudata* for the pygofer without caudal prolongation.

Type material. Holotype: ♂, China: Yunnan Prov., Kun-

ming, Wunquan, 23 March 1982, Wang Sumei and Zhou Jingruo, No. HO051842 (NWAFU). Paratypes: 5 ♂♂, Yunnan Prov., Lvchun, China, 30 April 1982, 1,900 m, Jin Gentao, Nos. 18009808, 18009836, 18009837, 18009841, 18009872 (deposited in SEM).

Size. Length of body to ends of forewings: ♂ 5.4–5.6 mm.

Description. Yellow to brown with well-expressed brown or black pattern. Vertex with a transverse black streak each side of midline on fore margin, sometimes fused medially, and a broad brown transverse band between ocelli, often extending to ocelli (Fig. 51). Face pale brown, with faint and often partly merged brown arched lines (Fig. 52).



Figs. 51–58. *Scaphoidella acaudata* sp. nov. **51)** Head and thorax, dorsal view; **52)** face; **53)** forewing; **54)** ♂ pygofer side, lateral view; **55)** genital valve, subgenital plate, style and connective, ventral (left) and dorsal (right) views; **56)** aedeagus, dorsal view; **57)** aedeagus and connective, left lateral view; **58)** connective.

Pronotum yellowish brown with several indistinct brown spots at anterior margin (Fig. 51). Scutellum pale yellow with a triangular marginal spot on each side of anterior margin and posterior to scutellar suture, light brown (Fig. 51). Forewings pale brownish hyaline with black to dark-brown veins and darkening in most cells; spot on apex of claval veins and on transverse costal veins, dark brown (Fig. 53).

External features as in generic description.

Pygofer side triangular without caudal process, with several macrosetae distally. Subgenital plate elongate, tapering to narrowly rounded apex, lateral margin with a row of macrosetae in distal half (Fig. 54). Styles with area basad of lateral lobe relatively short, quadrate, inner and outer apophyses of similar length, poorly differentiated and very short; lateral lobe well developed; apical process moderately long, straight (Fig. 55). Connective Y-shaped, shaft long and arms well developed (Figs. 55, 56, 58). Aedeagus with shaft elongate, curved slightly dorsally in lateral view with ventral margin angled slightly basad of mid-length, two short dorsolateral appendages near apex; gonopore apical on ventral surface, elongate; preatrium short with a pair of long, sinuate paraphyses, extending beyond shaft apex; basal apodeme moderately long (Figs. 56, 57).

Distribution. China (Yunnan).

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